



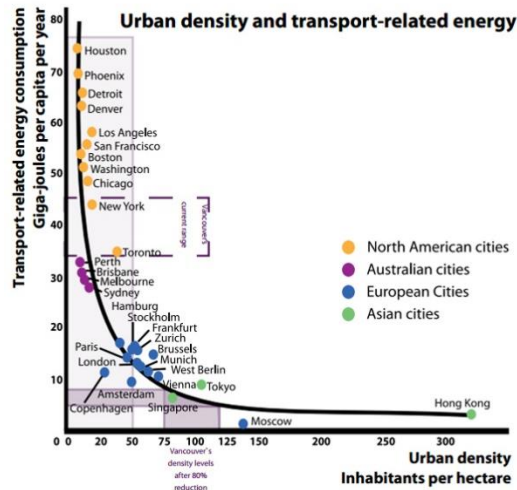
POTSDAM INSTITUTE FOR
CLIMATE IMPACT RESEARCH

City Density and CO₂ Efficiency

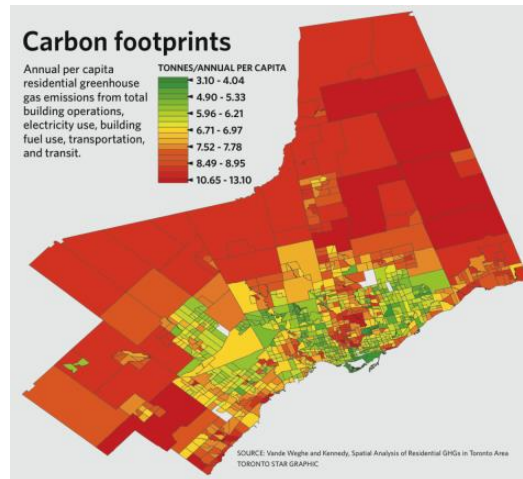
Ramana Gudipudi, Till Fluschnik, Anselmo Garcia Cantu, Carsten Walther, Juergen Kropp

**Mr. Ramana Gudipudi,
Msc. Urban Management**

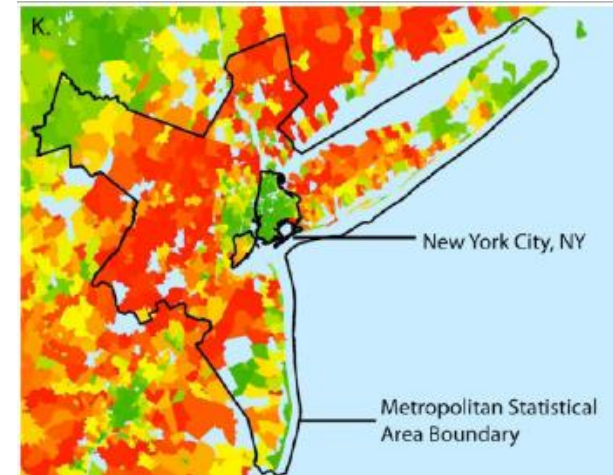
Background



Source: Newman and Kenworthy (1989)



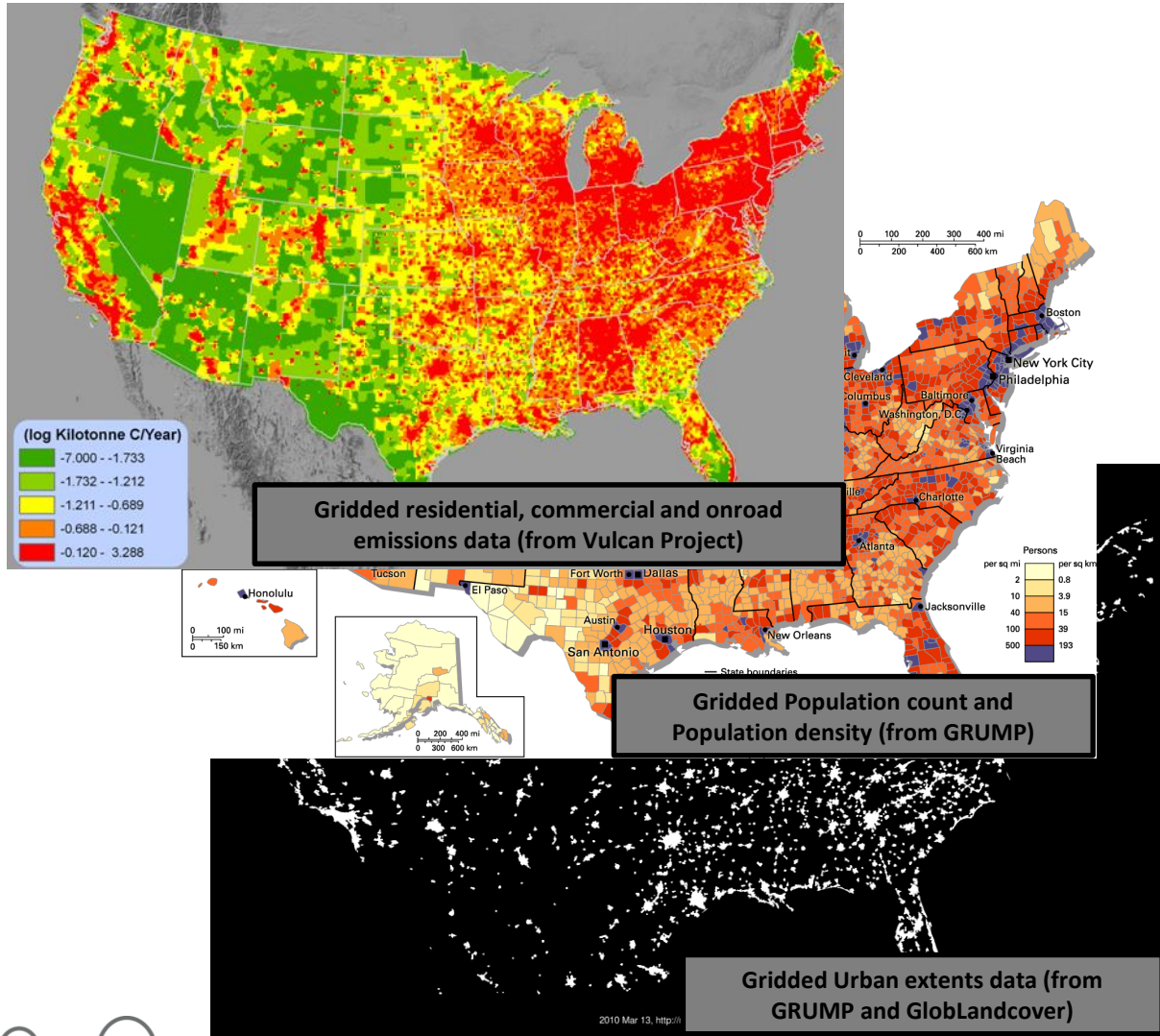
Source: Vande Weghe and Kennedy (2007)



Source: Jones and Kammen (2013)

- Studies done so far at different spatial scales on estimating the relationship between urban population density and energy consumption (and/or GHG emissions) showed different results
- The methodology used for analysis (though internally consistent) varied significantly (especially with respect to GHG emissions comparison)

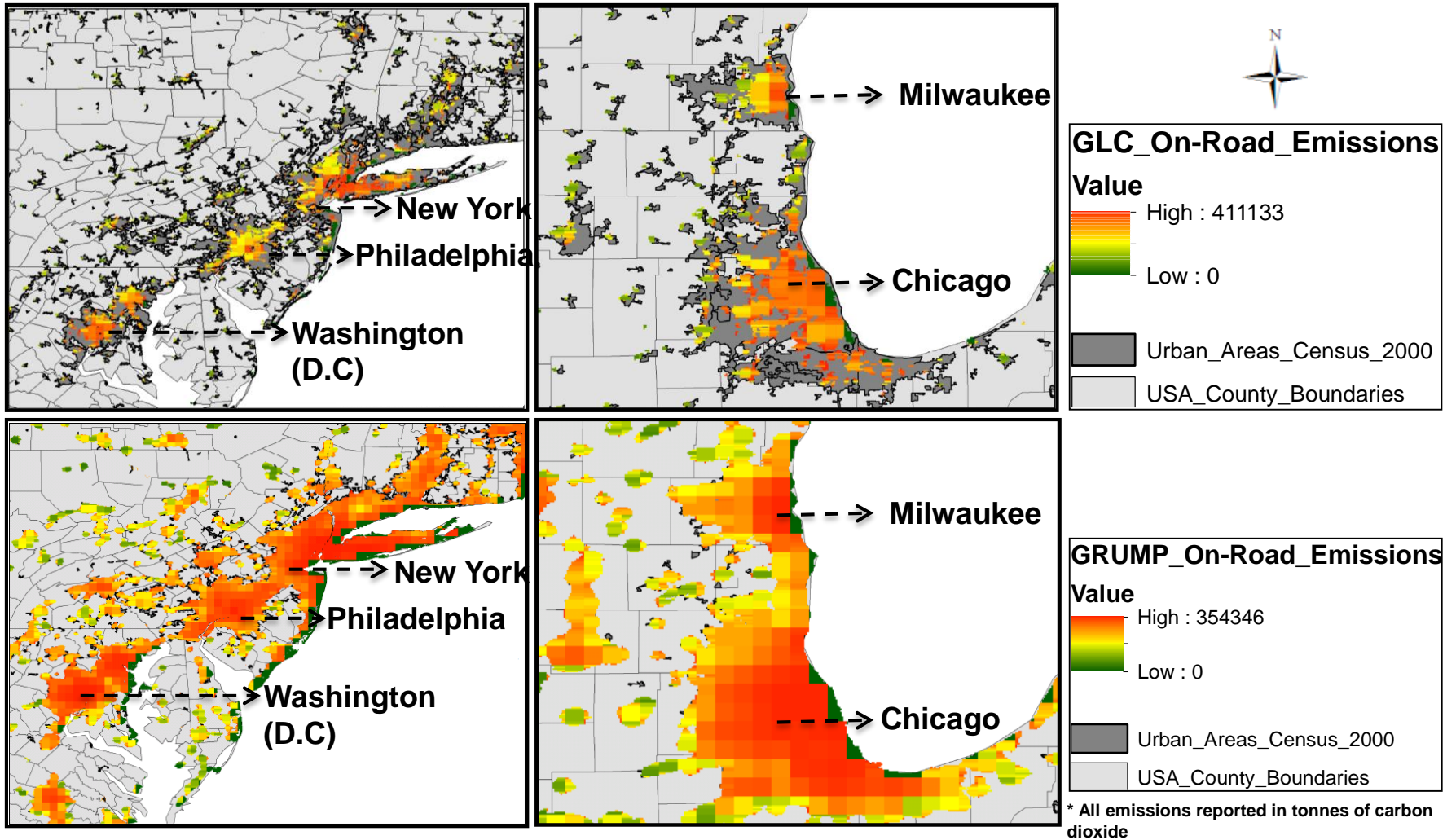
Data and Methods



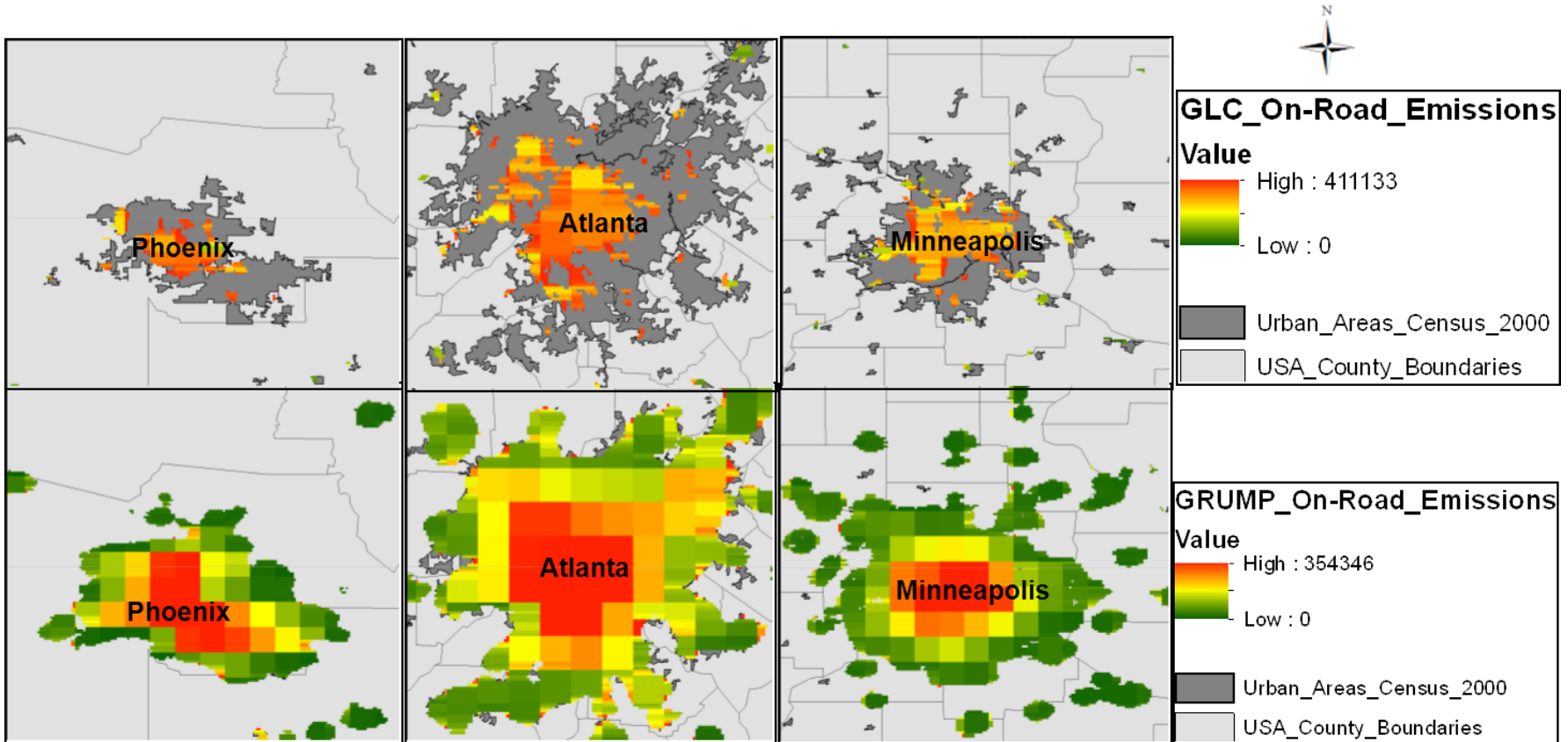
City Clustering Algorithm (CCA)

Unique urban extents with corresponding population density and sectoral emissions at various threshold distances

Comparison of GRUMP and GLC Urban Extents



Comparison of GRUMP and GLC Urban Extents (contd.)

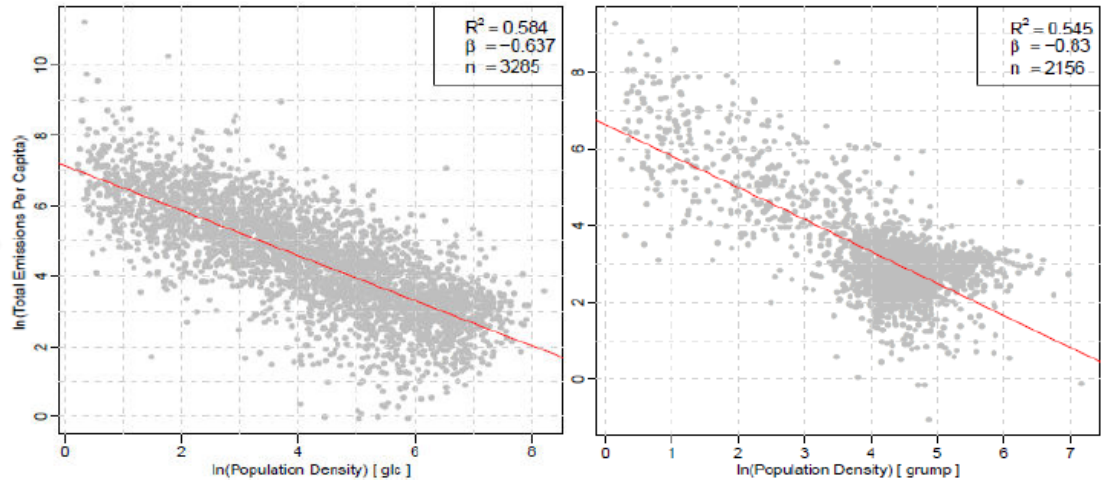


* All emissions reported in tonnes of carbon dioxide

Key Results

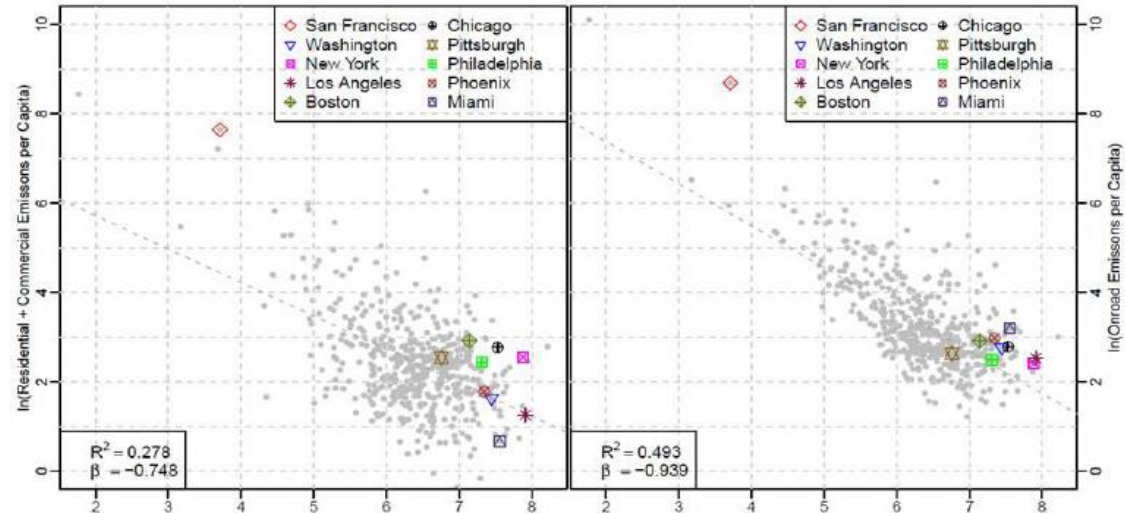


1. We found that CO₂ efficiency increased with increase in population density for both landuse datasets used
2. Our analysis suggests that doubling the population density would lead to reduction in CO₂ emissions atleast by 35%



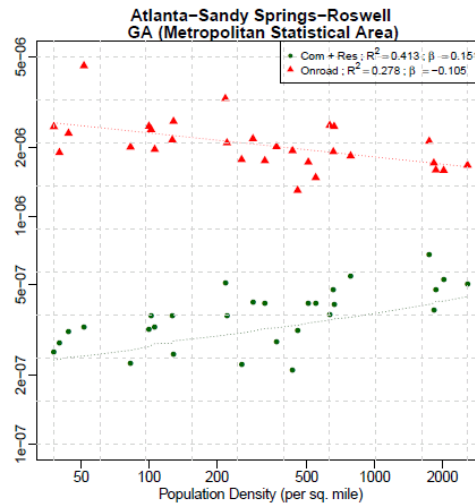
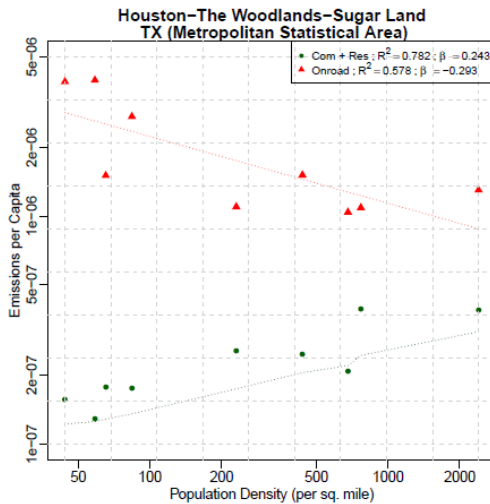
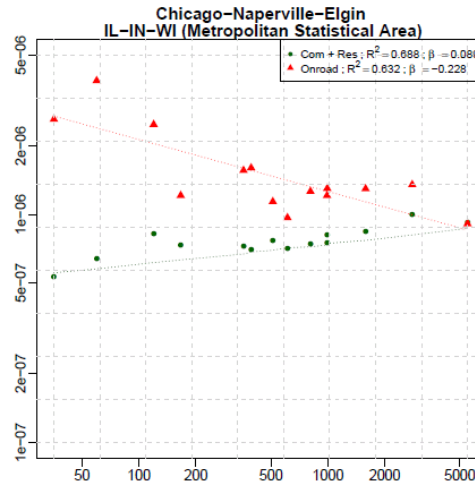
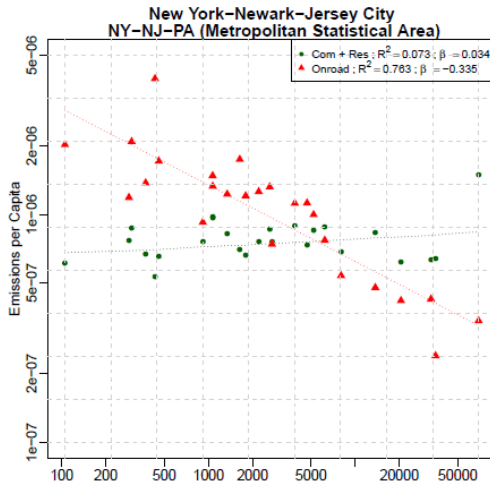
Relationship between population density and CO₂ emissions per capita for GLC and GRUMP at 5km cluster distance

3. The influence of population density is more pronounced in the case of on-road emissions than emissions from buildings (residential and commercial) for largest emitting 500 clusters



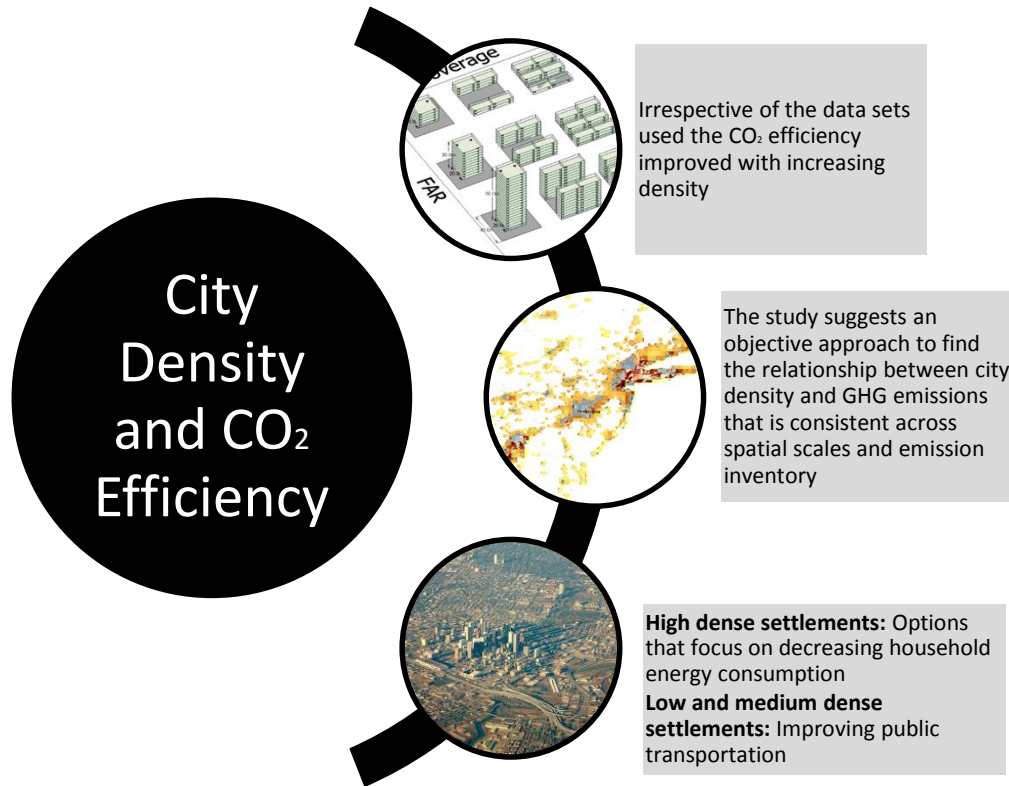
Relationship between population density and CO₂ emissions per capita for GLC at 5km cluster distance for 500 largest emitting clusters

Key Results (contd.)



- The building emissions per capita are found to be more than the onroad emissions per capita. This trend is found only in MSA's which are located in colder regions
- The density where both emissions are low is found to be different from one MSA to another.

Study Implications



Study Limitations:

- The impact of increased electricity consumption (and therefore the subsequent GHG emissions) in high dense settlements still unclear

Thank You!!!

Planned Submission: „City Density and CO₂ Efficiency“, Ramana Gudipudi, Till Fluschnik, Anselmo Cantu, Carsten Walther, Juergen Kropp, 2015